CASE TEACHING NOTES
for
"Irradiation: Is it Consumer-Friendly?"

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INTRODUCTION / BACKGROUND

This case works best in Introductory Food Science classes, which usually consist of students from technical and non-technical majors. The discussion of this case between science and non-science majors in the class tends to mirror the polarization of the issues surrounding this topic out in the real world: usually, the science majors will end up representing the position of the food industry on advanced technologies and the non-science majors the viewpoint of the consumer.

This case is also appropriate for use in classes on Food Product Development, Food Processing, Unit Operations in Food Processing, or any other course that deals with food preservation technologies and/or the processing of meats. Prior to the discussion of this case, the students should have had some background on food preservation technologies and on ionizing radiation and its impact on biological materials.

Objectives

- To introduce students in food science curriculum to consumer perceptions and beliefs on scientific topics.
- To teach students how the food industry evaluates processing technologies from a business perspective.
- To highlight to students in food science curriculum the importance of working together with marketing professionals and to expose them to strategies for consumer education programs.

MAJOR ISSUES

Science and Technology Behind Food Irradiation

Food irradiation is currently approved for use with over 40 food products (e.g., spices, potatoes, poultry, red meat) in over 47 countries. The Institute of Food Technologists, American Society of Microbiology, American Medical Association, World Health Organization (WHO), and Food and Agriculture Organization (FAO) have all approved it as a safe preservation process. Up to a third of the world's food supply is lost to post-harvest losses. Irradiation can be used to destroy pathogens (disease causing microorganisms) and parasites in food products and packaging materials. Irradiation has been shown to extend the shelf life of fresh fruits and vegetables, to control sprouting of fresh vegetables (garlic, onion, potatoes, carrots), to accelerate the maturing of cheese, to function as a replacement for post-harvest fumigants (methyl bromide, ethylene dibromide, and ethylene oxide) used in grain products, and to extend the shelf life of fresh meat products.

During irradiation, the food is exposed to the ionizing energy source and the food absorbs a precise dose of radiation. The absorbed dose is controlled by the intensity of the radiation source and the time of exposure of the food to the source. The SI unit to describe the dose is gray (Gy). No harmful by-products are produced when food is irradiated at the low doses prescribed for fruits and vegetables.

Minimal degradation of nutritional value of foods takes place since the temperature of the product does not rise during this process (Olson 1998). At the moderate doses recommended for meats, no additional by-products are produced by irradiation that are not also produced by conventional cooking of the meat.

In 1993, food irradiation was approved by both the U.S. Department of Agriculture (USDA) and the Food and Drug Administration (FDA) for use on poultry. In 1994, Isomedix, Inc., a New Jersey manufacturer of medical sterilization equipment, petitioned the regulatory agencies for approval of irradiation for red meat products. In view of the increasing number of cases of *E. coli* contamination in meat products, FDA and USDA approved irradiation of fresh and frozen beef and pork in December 2, 1997, as long as the products were appropriately labeled. Based on studies on irradiated foods, which included toxicity studies, feeding studies, and reproduction and genetic toxicity studies, the FDA concluded that irradiation of red meats did not present a toxicological hazard. The American Meat Institute and National Cattleman's Beef Association, the trade organizations representing the meat industry, applauded the passing of this regulation as the means of providing the industry with a valuable food safety tool for protecting the general health of consumers.

Gamma rays, high-energy electrons, and x-rays are the three types of irradiation approved for food use. Gamma rays are a by-product of the radioactive decay of either Cobalt-60 or Cesium-137; high-energy electron radiation and x-ray are produced from electricity. Irradiation kills foodborne pathogens by destroying the DNA of the bacteria. The exposure times and energy levels of radiation sources approved for foods are inadequate to induce radioactivity in the food products.

In the United States, irradiation is considered to be a food additive under the 1958 Food Additives Amendment to the Food, Drug and Cosmetic Act. Irradiated food products sold at retail have to be labeled with the green international symbol plus the words "Treated by Irradiation" on the front panel. The regulatory agencies must also pre-approve the packaging materials for use on foods being irradiated. Polystyrene is the "packaging material of choice" for use on irradiated foods.

Food Irradiation Costs

Return on investment is an important consideration for any food processor considering embracing a new technology such as irradiation. The estimated cost of building an irradiation facility is between one and three million dollars depending on the size of the facility (EPRI 1998). On a per unit basis, it costs around $10 to $15 per ton for low dose applications, such as those used to inhibit sprouting in vegetables. It costs around $100 to $250 per ton for high dose applications, such as those used in meat products. This is in line with the typical costs for other technologies used in the food industry. The irradiated products might cost the retailer an additional two to three cents more per pound as compared with non-irradiated products, but the savings resulting from increased shelf life and reduced wastage might compensate for these additional costs. So, the investment in this technology has a finite payback period.

Consumer Acceptance

Government and industry approval of irradiation does not result in an automatic acceptance of irradiation by the consumer. Consumers in general have come to suspect new technologies applied to foods that are near and dear to them. In the past, consumer groups have threatened to boycott and pursue legal action against food companies for marketing irradiated food products over questions concerning the long-term safety of eating irradiated food products. A CBS poll in December 1997 revealed that over 70 percent of the consumers questioned would not knowingly eat irradiated food products. Consumers in general think of irradiated foods as being radioactive (glow-in-the-dark).

The Center for Science in the Public Interest has mounted an aggressive campaign against irradiated foods, claiming irradiation degrades the nutritional content of the food product and causes cancer in the long term with prolonged use. Food and Water, another grassroots organization, successfully mounted an anti-irradiation campaign against Hormel in 1996 and prevailed. In the early 1970s, anti-irradiation activists claimed that unique radiolytic by-products (URP) are released by irradiation. An article in the October 1985 issue of *Health Quotes* entitled "X-rayed Apple" claimed the presence of 65 volatile radiolytic products in irradiated meats. Leading international organizations and universities have refuted these claims, and none of the research has demonstrated the presence of URP's in properly irradiated food products. When very high doses (much higher than recommended by FDA and USDA) are given to the food product, a loss of texture and color in produce items and acceleration of rancidity in meats have been reported.

The acceptance of irradiated meats in the marketplace will depend on the perceived added value of the products by the end users. These include food service operators, supermarket chains that are concerned about their image, and consumers who are concerned about the well being of their families. The key to consumer acceptance is education, whereby accurate information is provided to the consumer before the product is put on the supermarket shelf. It is the role of the food industry to convey the correct information and the benefits to the end users.

A study done at Iowa State University and Kansas State University showed that consumers are willing to pay for irradiated food products. More than 80 percent of the respondents to a survey indicated a preference for irradiated products when the benefits of irradiation were explained to them. They also studied the impact of product information on consumer choices. They found that "negative" information, whether correct or incorrect, had a dominant influence on consumer purchases. A study conducted at the Center for Consumer Research at the University of California, Davis, revealed that after viewing a 10-minute informational video on irradiation, interest in buying irradiated foods increased from 57 to 82 percent. When consumers are informed of the facts, they realize the benefits and can see beyond the myths associated with irradiation (Hollingsworth 1998). The overall number of consumers concerned about the safety of irradiated foods has decreased within the last decade (Bruhn 1995a).

There is risk associated with most of our day-to-day activities such as driving or just crossing the road. However, when it comes to processed foods, the consumer generally expects the food industry to adopt a zero risk policy with respect to the safety of food products. But a key question is whether the consumer is willing to pay the higher price associated with the lower risk.

Consumer Education

The consumer will eventually dictate the future of irradiation as a technology for increasing the shelf life of food products. The more consumers know about this technology, the more willing they will be to embrace it (EPRI 1998). Consumer education on irradiation as compared to other processing technologies plays an important role in changing consumer attitudes about irradiation. Lusk *et al.* (1999) also found that when consumers were given the appropriate information, they were less concerned about irradiation. Even a minimal presentation of the facts related to food irradiation can lead to significantly less concern over this technology. Resurreccion and Galvez (1999) conducted a survey-type study and found that educational programs are very valuable. They simulated the supermarket setting, and found that the number of respondents willing to buy irradiated foods increased from 51.5 to 71.3 percent after an effective educational program was used as an intervention measure.

The National Food Processors Association (NFPA), an industry-based group from Washington, D.C., recommends a three-step consumer education program on the benefits of irradiation: (1) Publicly inform consumers about irradiation of foods through the U.S. Surgeon General's Office, the Centers for Disease Control (CDC), and the FDA; (2) Ensure that labeling disclosure requirements for irradiated products help to inform consumers about the benefits of the process; and (3) Create a task force to coordinate efforts and further identify impediments to getting irradiated foods into the marketplace.

Consumer education and communication strategies on irradiation should involve identifying the audience, selecting the appropriate communication medium, presenting the benefits of irradiation from the consumer's perspective, responding to environmental and worker safety issues, and addressing the general myths perpetuated by the special-interest groups (Bruhn 1995b).

Target Audience

Irradiated products have to be marketed to the right segment of the population. Males, older adults, and those with a better education have more positive attitudes towards irradiation (Schutz *et al.* 1989). On the other hand, Lusk *et al.* (1999) found that females, older consumers, and those with lower education and income levels tend to be more concerned about irradiation. There is also an inverse relationship between beef consumption and concern about irradiation. Irradiation is particularly helpful for at-risk groups whose immune response is compromised by illness or disease. These include children under five years of age and older adults. Initial marketing efforts should be directed at younger men with a high level of education and income who are heavy consumers of beef. It could also include parents of young children and adults over 50.

Communication Medium

Over 50 percent of consumers check ingredient labels on the foods they buy (Schultz *et al.* 1989). The statements made on the label about the benefits of irradiation can influence the consumer's decision whether to buy the product or not. Identification of consumer benefits through label statements and the use of descriptive information on the label can positively influence consumer perceptions of irradiation. The label has to be simple to read and understand. Statements made on the label should be carefully evaluated to make sure they communicate the right information to the consumer.

Consumers get the majority of science and food safety related messages from radio, television, newspapers, and magazines. Messages in the public interest could be broadcasted through these media with the help from the Cooperative Extension. In general these messages are most effective when repeated in multiple sources. The popular and professional press can also help to deliver the message. Press kits on irradiation for the media may be appropriate. Point-of-purchase informational flyers and other educational materials should be pursued. Articles can be made available through the Cooperative Extension and USDA's Food Safety and Inspection Service and in supermarkets. Consumers would be very receptive to endorsements by the American Medical Association and the World Health Organization.

Consumers have less confidence in the information put out by government agencies than by health professionals. Leaders of consumer groups, representatives of groups at risk, and media persons could be invited to attend regional workshops conducted by health professionals. Encourage a dialogue between consumers and public health officials and scientists. It should be stressed that the major benefit of irradiation is the reduction of foodborne microorganisms. The role of irradiation to replace less safe chemical fumigants such as methyl bromide should also be emphasized. In addition, nutritional safety and environmental safety should be addressed. A full marketing program analysis needs to address price, product, position, and promotional issues. An important point to be made to the consumer is the product differentiation of irradiated product.

Another powerful and yet inexpensive medium is the Internet. A company could develop and put all of its educational materials on its web site and provide links to other web sites that discuss the irradiation of food products.

Actual Message

Irradiation should be explained in lay terms (e.g., irradiation is a treatment of food with energy from gamma and x-rays to kill harmful microorganisms). Comparisons can be made to other food preservation technologies (e.g., irradiation is like the pasteurization of milk; pasteurization uses thermal energy and irradiation uses another form of energy). Irradiation should be described as an additional measure implemented to enhance overall food safety. Consumers should be made aware of harmful microorganisms that can grow within a food product even under sanitary conditions. Misconceptions perpetuated by the special interest groups should be refuted. Some of these myths include: irradiation is not safe for human foods, the public will not know when foods are irradiated, irradiation will add a considerable amount of radioactive waste to the environment, and irradiation destroys the nutritional content of foods.

CLASSROOM MANAGEMENT

It is recommended that this case be given to students at least a week prior to the case discussion period. The students can use the study questions as a means to arrive at their own personal decision as to how Leo Altamari should proceed in terms of the actions his company should take in the next few months. One way to manage the discussion in the classroom is to simulate the staff meeting. This can be facilitated by dividing students into smaller groups; it would be helpful if each group had representation from both science and non-science majors. Then each member of the group could take on the role of the people that will be at the next staff meeting and engage in role-playing. After a 25- to 30-minute discussion, each group could be asked to make a recommendation as to what Leo Altamari should do next. The instructor could then conclude by discussing the material included in the case teaching notes. The instructor should emphasize the fact that the food industry is marketing driven and hence it is very important to understand consumers' perceptions and preferences. There is also an implicit need within the food industry for scientists and marketing professionals to communicate and work together in order to successfully introduce new products and technologies into the marketplace.

Follow-up assignments could include students coming up with the actual advertisements, infomercials, editorial/news articles, brochures, website information, etc., that might become the content of an overall consumer education program launched by Kutztown Meat Packing Corporation.

ANSWER KEY

Answers to the questions posed in the case study are provided in a separate answer key to the case. Those answers are password-protected. To access the answers for this case, go to the key. You will be prompted for a username and password. If you have not yet registered with us, you can see whether you are eligible for an account by reviewing our password policy and then apply online or write to answerkey@sciencecases.org.

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Disclaimer: This case and the characters depicted in it are fictitious. The case is based on the current controversy facing the food industry over the adoption of irradiation as a food preservation technique.

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